States Industries of the Future

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ABSTRACT

Industries of the Future, a partnership strategy of the Department of Energy's Office of Industrial Technologies (OIT), has successfully facilitated development of industry visions and roadmaps for the Agriculture, Aluminum, Chemicals, Forest Products, Glass, Metalcasting, Mining, and Steel industries. (Similar documents are expected to emerge from the Petroleum refining industry this year.) Beginning with a pilot project in West Virginia, OIT is now partnering with states to pursue these industry-defined visions and roadmaps on a state level. The goals of this initiative are to boost industrial efficiency and productivity by working with states that have significant activity in one or more of the nine target industries. A typical state approach establishes a state team, targets specific industries, promotes industry alliances, builds industry interest and leadership, identifies business and technology needs, outlines a state strategy, and generates action plans and partnerships. State benefits include potential industry and job growth, alignment of customer and supplier base with core industries, improved environmental performance, increased resource efficiency, and enhanced ability to compete for national resources.

In Fiscal Year 1998, DOE awarded 16 grants to 20 states to carry out a range of States Industries of the Future and deployment projects. Four of these projects are highlighted in this paper: Industries of the Future--West Virginia; the Northeast Collaborative project under the leadership of the New York State Energy Research and Development Authority (NYSERDA); Michigan Industries of the Future; and Alabama Industries of the Future. These projects, which represent a variety of approaches, have yielded effective techniques for building partnerships and useful lessons learned. A broad range of tools are available to assist states in initiating and supporting state-level Industries of the Future activities.

Introduction

The Office on Industrial Technologies (OIT), part of the Department of Energy's Office of Energy Efficiency and Renewable Energy, works to provide a broad array of products and services to industrial customers, from the shop floor, to research and development laboratories, to the executive suite. It delivers a portfolio of productivity-enhancing products, services, and emerging technologies tailored to its customers' needs. OIT is encouraging industry-wide efforts to boost resource productivity through a strategy called Industries of the Future (IOF). The Industries of the Future strategy focuses on the following nine energy- and resource-intensive industries: Agriculture, Aluminum, Chemicals, Forest Products, Glass, Mining, Metalcasting, Petroleum Refining, and Steel. These energy-intensive industries account for over 75 percent of the energy consumed by U.S. manufacturing. They face significant challenges in remaining globally competitive and environmentally acceptable into the 21st century.

Encouraged by initiatives and innovative approaches by a number of states, OIT has developed a new focus area called *States Industries of the Future*. This program assists states and

regions that want to use Industries of the Future visions and roadmaps to mobilize energy- intensive industries and accelerate deployment of advanced industrial technologies and best practices. The goals of this initiative are to begin work in states that have significant concentrations of activity in one or more Industries of the Future, and to develop state-specific approaches linked to national visions and roadmaps. A typical state approach establishes state teams, targets industries, arranges industry alliances, builds industry interest and leadership, determines business and technology needs, designs a state strategy, and develops action plans and partnerships. States benefit from implementing Industries of the Future by fostering industrial growth and new jobs, aligning the customer and supplier base for core industries, improving environmental performance and resource efficiency, and helping state businesses compete more successfully for national resources.

Industries of The Future Strategy

Industries are being squeezed between the needs of being competitive in changing global markets, accelerating product development and moving to more efficient, lower-cost technologies; and the rising costs of R&D, customer pressure to lower costs, and stockholder demands for near-term profits. New strategies for technology research are essential to future success. The Industries of the Future strategy provides a way that industry and government can work together to meet these challenges.

The generic process, which OIT and industry have used successfully since 1994, begins with the creation of a vision for the future. This industry vision is developed at the highest levels of industry. Chief Executive Officers (CEOs) and other industry leaders assess the current situation, market trends, threats to future success, and potential opportunities, then paint a clear picture of the industry's desired future over the next 20 years or more. The vision sets long-term goals and serves as the basis for partnerships between industry, government, and other key players.

The next step –an industry roadmap – represents the critical link between the broadly defined strategic goals contained in the vision and a detailed research portfolio that will be pursued through industry/government partnerships and other mechanisms. As with the vision, the roadmap is developed by industry and for industry. It requires the involvement of those most knowledgeable about the performance, technologies, and research needed to realize the vision. Multiple roadmaps may be needed for industry to target key areas or subsectors.

To facilitate joint efforts, DOE then formally establishes an industry partnership by entering into a compact with the industry. The compact sets forth in writing the agreement between the parties to work toward jointly defined goals and to implement the activities set forth in the vision and roadmap(s). The compact is signed in a public ceremony to communicate the level of commitment of each member of the partnership.

A successful partnership involves developing an operating infrastructure. This infrastructure involves establishing coalitions or networks of industry, academia, trade societies, government, and others specifically to implement the vision and roadmap. These strategic alliances are critical for the successful realization of vision goals. The coalitions are responsible for outlining clear operating procedures for the solicitation, review, and selection of technical proposals and for outlining a wide variety of ways in which parties can work together.

Once the vision and roadmap have been developed and the infrastructure is in place, the partnership can begin soliciting and awarding research projects and cooperating in other specified ways. Solicitations are developed to request proposals that address the priority research topics

identified in roadmaps. Solicitations are open, competitive, and widely communicated to the research community. The coalitions also provide periodic review and revision of the roadmaps. All aspects of the research partnership are dynamic, undergoing regular review and adjustment.

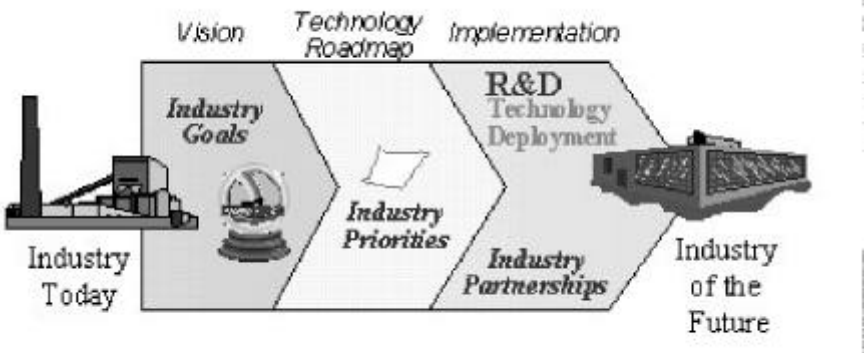

Figure 1 - Industries of the Future Process

States Industries of The Future - Background

Partnering with state governments is not new in the Office of Industry Technologies or the Department of Energy. State energy programs were established by Congress in 1976 under the name State Energy Conservation Program (SECP). SECP was later combined with the Energy Extension Service, and in 1996, Congress merged the SECP with another formula grant program, the Institutional Conservation Program (ICP). The new name became the State Energy Program (SEP). Consolidation of programs covering a range of energy efficiency and renewable energy activities has increased the flexibility of states in managing energy programs. In addition, the Energy Policy Act of 1990 recognized the crucial energy role played by states and expanded the policy, program, and technology deployment role of the states.

In 1996, special project funding for Industrial Technologies was added to the State Energy Programs. In the initial years, program activities were primarily focused on deployment of industrial technologies -- an example being Motor Challenge activities at the state level. In 1997, OIT initiated a pilot project with West Virginia to implement Industries of the Future on a state level. Due to the rapid success in organizing a West Virginia industry program, States Industries of the Future was offered as a SEP-Special Projects alternative in FY 1998, and 16 state grantees (plus 5 additional state partners) initiated activities for States-IOF. Figure 2 shows the states winning industry special projects grants in FY 1998

The FY 1999 solicitation for SEP - Special Projects for Industry sought projects that specifically targeted state implementation of Industries of the Future. The goals are to:

- increase the awareness of Industries of the Future processes and products at the state

government level;

- deliver products and services in a coordinated and useful manner; and
- involve more companies in efforts to implement Industries of the Future visions and roadmaps.

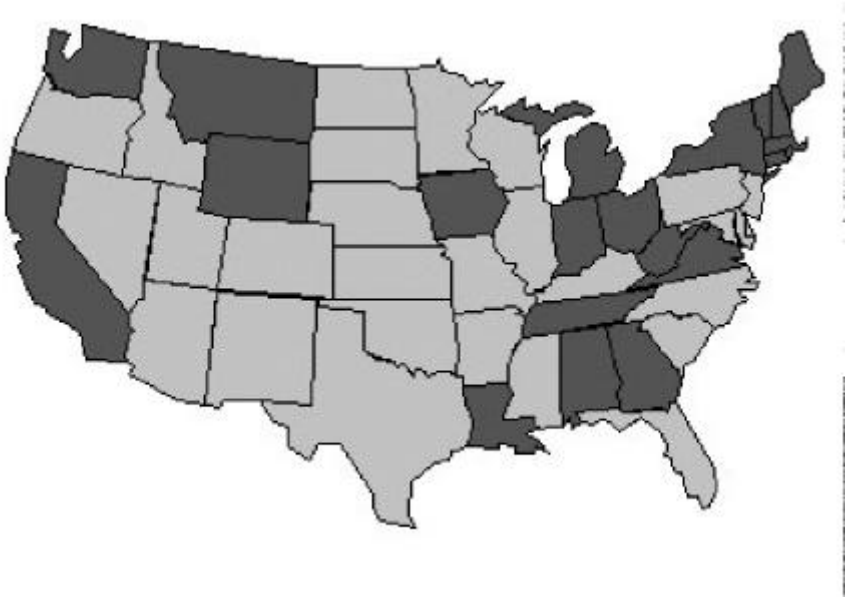

Figure 2. FY1998 States Winning SEP - Special Projects Grants

Industries of The Future - West Virginia

In partnership with OIT, West Virginia was the first state to develop a state-level Industries of the Future program. In 1997, following successful work in developing a Carbon Products Industry vision, Carl Irwin of West Virginia University (WVU) and Jeff Herholdt of the West Virginia Development Office worked together to design and initiate the project. Using seed money from OIT, the program asked such questions as: "Which industries will be thriving in our state in 20 years...40 years?", "Can our traditional industries be healthy and globally competitive in the 21st century?", "What new companies will be here to employ our citizens?" *Industries of the Future - West Virginia* or *IOF-WV* was modeled after the national Industries of the Future program, to be a catalyst for projects, partnerships, and programs to increase energy efficiency, reduce and utilize waste materials, and improve industrial productivity. Five West Virginia industry sectors were initially targeted: aluminum, steel, glass, chemicals/polymers, and wood/forest products (metal casting and mining were added in 1998).

Meetings were convened around the state with the initial five industry areas to familiarize industry leaders with visions and roadmaps developed at the national level, to discuss important issues and concerns, and most importantly to identify opportunities for joint projects and ways to collaborate. All the industry groups came together for a statewide meeting, keynoted by the Governor, in Charleston in December 1997. In addition to industry representatives, the forum included state and federal officials, university researchers, DOE laboratory researchers, trade

association representatives, and national IOF participants. Plenary sessions provided presentations by state and industry officials, and breakout work sessions were held to identify industry-specific needs, programs, and potential projects to benefit industry. Cross-cut breakout groups were formed to discuss issues of interest to more than one industry. Results of these brainstorming sessions generated concrete ideas for priority projects. This furthered West Virginia's strategy of establishing a close working relationship between industry people, university researchers, state government officials, and other national experts; the ideas were formulated into specific proposals and resources were found to implement them.

Examples of the kinds of projects which developed from collaborations include the following:

Aluminum: One large WV aluminum company, Century Aluminum, manufactures a special aluminum alloy used in about sixty percent of domestically produced car and truck radiators. An IOF-WV project was created to develop new pot lining materials to reduce electricity consumption in the smelting process.

Steel: Weirton Steel, one of the largest employers in the state, is working on a National Industrial Competitiveness through Energy, Environment , Economics ($NICE^3$) project on Rapid Edge Heat Technology to reduce energy use in treating the steel slab prior to finish rolling.

Glass: A research team, including Fenton Glass, Pilgrim Glass, David Lynch Glass, WVU, and the Federal Energy Technology Center (FETC) is working on the use of laser technology to prevent "crack-off" i.e., breaking the finished glass project when it is separated from the blow tube. This could substantially increase productivity in the hand glass industry.

Chemicals/Polymers: West Virginia's Polymer Alliance Zone (PAZ), DN American, MBA Polymers and WVU are collaborating on a polymer/electronics recycling project for end-of-life electronics such as CDS, computers, and TV cases.

Wood/Forest Products: A project has been initiated with 3M Corporation and Touchstone Research Laboratory to reduce wood waste in the lumber industry by developing a thin kerf saw blade. Cogeneration technology is being installed at Mullican Lumber.

West Virginia's IOF Strategy

West Virginia's overall strategy is to build a coalition of State Industries of the Future companies, government and industry research groups, political and labor leaders and the DOE's Office of Industrial Technologies to implement activities which will develop West Virginia's industry. The approach includes finding people who can help, focusing on the real needs of industry, and acquiring the required resources. The program is based at West Virginia University, so it was natural that the team built on existing relationships between university researchers and industry. The researchers helped pull in corporations and large trade associations within the state. The West Virginia Development Office also lent the program enthusiastic support and many useful ideas. Similarly, the Industrial Assessment Center located at WVU provided useful contacts and suggestions.

Industries were addressed individually to assure that their needs were being met. For example, the aluminum industry has a high electricity demand for its smelting process, and they wanted some help with that. The steel industry is concerned with competitiveness and was looking for energy cost savings. The hand glass industry was losing a lot of product due to a crack-off problem. The chemicals and polymers manufacturers were keenly interested in recycling and moving toward zero

discharge. The wood products industry wanted help in improving primary and downstream processing efficacy and in finding some way to use all the sawdust they produce. The metalcasting industry would like to be able to reuse the sand after it has been used in the casting process.

The IOF-WV team became familiar with visions and roadmaps developed at the national level and tried to match state needs with national needs. The critical result is a transformation of key industries in the state to becoming vision-oriented, with the aggressive drive toward saving energy and reducing waste, and more importantly becoming increasingly productive and globally competitive - an outcome which is good for West Virginia and good for the nation.

Northeast Regional Technology Collaborative

With strong support from the New York Energy Research and Development Authority, an Industries of the Future effort is underway involving the States of Maine, Vermont, Rhode Island, Massachusetts, Connecticut, and New Hampshire. This industrial partnership, known as the "Regional Industrial Technology Collaborative," has held or is planning regional technology transfer sessions pertaining to motors, steam, combined heat and power, and compressed air.

As part of their strategy, energy offices in these states work with mechanical engineering faculty and students at the University of Maine, University of Massachusetts Amherst, and Hofstra University to coordinate collaborative industrial efficiency activities and to lend additional expertise to industrial assessments. The Office of Industrial Technologies' *Industrial Assessment Centers* located at these universities provide free energy and waste assessments to businesses that meet established criteria. Hofstra University is hosting the next event, which will focus on *Combined Heat and Power* applications. Also, a Compressed Air Challenge Training Pilot workshop is planned.

In addition to activities which are part of the Northeast Regional Industrial Collaborative, the States of Maine, Vermont, and New York are sponsoring additional Industries of the Future activities that focus on certain energy-intensive industries important in their states. Vermont is focused on community-level combined heat and power applications. New York has initiated *Technology Blueprinting* activities with its ceramics, metal products finishing, and forest products industry. Maine, through its *Manufacturing Extension Partnership* program and the Maine Chamber and Business Alliance, is working with its secondary wood products industry to determine how near-term energy efficiency can reduce waste and operating costs. The Maine Wood Products Association is also working with DOE to determine whether advanced technologies developed by national Industries of the Future partnerships can be transferred to its members.

Michigan Industries of the Future

A Michigan Industries of the Future program was initiated in 1998 to "extend the connections of the national IOF program to organizations involved with industrial technology and process improvement." Michigan has important concentrations of energy-intensive industries and ranks seventh in the nation in industrial energy consumption. The Michigan IOF program has defined two user-oriented groupings of industries important in Michigan. These are: 1) automotive, which relies on materials and products from the aluminum, steel, metal casting, glass, and chemicals industries; and 2) renewable resources, which draws from the agriculture, forest products, and chemicals industries. The program targets these industries as well as all other companies in their supply chain.

The program has four main objectives:

- "Provide information to Michigan organizations such as universities, corporations, and research institutes about the IOF program and other OIT programs such as the Small Business Innovation Program, Inventions & Innovation Program, and the NICE[3] program.
- Broaden the base of Michigan organizations knowledgeable about and participating in IOF-related activities at both the national and state level.
- Build public-private partnerships in Michigan to advance technologies and processes that are more energy efficient, environmentally sound, and economically effective.
- Identify high-priority areas of Michigan-specific interest regarding energy-environment-economic improvements in industrial operations, and pursue research development-deployment opportunities to meet these priorities."

Workshop groups (including both industry and technology developers) will provide leadership in building the action agenda. Substantial effort will be made to establish effective networks to communicate among participating organizations and to diffuse information regarding technology and process improvements using both conventional and innovative electronic methods. The program will include focused workshops, statewide meetings, published materials, world-wide-web, e-mail, and list-serve connections to maintain the flow of information through key communication links.

In implementing the program, "gatekeepers," or leaders who can influence others in their industry, are being identified. Michigan has a number of industry leaders who have been active in the national IOF effort, including individuals at Dow Chemical, Dow Corning, and General Motors. Workshop groups consisting of industry representatives, customers, and technology developers are being formed to identify an action agenda and lead its implementation. Through such workshops, the program within a cluster area will be scaled up to a high-profile, widely attended forum or symposium that will attract additional industry people and provide an opportunity for industry input and interaction. Results of the forum will be used to develop an ongoing program tied to existing capabilities and other programs.

Alabama Industries of the Future

The goal of the Alabama Industries of the Future project is to transfer industry-developed visions for two of the Industries of the Future, forest products and chemicals, to constituent industries in Alabama. This project builds on existing industrial initiatives in Alabama to leverage pre-existing investments and capabilities in industrial energy efficiency and manufacturing assistance. This project is being accomplished through a cooperative effort led by the Industrial Energy Advisory Service in support of the Science, Technology and Energy Division of the Alabama Department of Economic and Community Affairs in conjunction with the Center for Forestry, Paper and Chemical Technology, which is one of ten regional centers of the National Institute of Standards and Technology (NIST) Manufacturing Extension Partnership.

The Industrial Energy Advisory Service currently is the primary clearinghouse for energy efficiency information for Alabama industries and promotes the DOE industrial efficiency programs. Its services include a toll-free information hotline, newsletters, executive briefs, technical assistance, and energy seminars and conferences. The program is supported by a team of experienced energy engineers and managed by an internationally-recognized energy professional. The specific activities supported through the Alabama Industries of the Future project include:

- Establishing a forest products and a chemicals steering committee to develop and support an outreach strategy and conference to transfer the national-level industry visions to Alabama industries
- Conducting a progressive, three-stage, direct-mail campaign to all the forest product and chemical industries in Alabama to distribute literature related to the Forest Products industry's *Agenda 2020*, and the Chemical industry's *Technology Vision 2020*, other DOE industrial efficiency programs, and conference promotional material;
- Working with the support of partner organizations and the steering committees, develop, promote, and carry out two two-day conferences: one targeted at the Alabama forest products industry on *Agenda 2020*, and the other targeted at the Alabama chemicals industries on *Technology Vision 2020.* Both conferences will focus on adopting the OIT *Industries of the Future* strategy on a state level, and will promote existing DOE-supported industrial technologies and energy-efficient practices.

State Industries Moving into the next Century

OIT hopes to establish state-oriented Industries of the Future in all states and regions where there is substantial economic activity in one or more Industries of the Future. The goals of these state-level activities are to increase awareness of the Industries of the Future processes and products at the state government level, to build alliances with industries within states, and to establish customer-oriented activities which can assist state industries in becoming more productive, and efficient in the use of energy and other resources.

OIT seeks to educate key government and industry decision makers in the states about products and services available through OIT, DOE, and the federal government; assist states in developing a state/region-specific approach to implementing Industries of Future; involve OIT Industries of the Future teams and industry partners in state-related activities and processes; and leverage the national benefits of energy efficiency, pollution prevention, and economic competitiveness achieved in the national IOF through wide implementation at state and regional levels.

There is no single best approach toward implementing Industries of Future at the state level. OIT encourages innovative approaches tailored to the specific needs of states and industries within the states. These strategies depend on a wide variety of geographic, technical, financial, and market factors.

Lessons Learned

While states and regions tailor their individual approaches to Industries of the Future, some of the common strategies and tactics that states have identified as successful include:

- Find industry champions, especially early on, to lead the process and bring in other industry players and interested stakeholders. Champions can be found in industry, academia, trade associations, energy centers, or other state organizations.
- Make use of existing ties with industry as well as national- and state-level trade associations to start the process. Identifying and establishing partners and initial work groups is sometimes a challenging task but often there are already contacts established for related activities which can be utilized.

- Sell state political leaders on the IOF concept--especially on how it can benefit the state. Enlist their support in developing state initiatives and tie into the state's priorities.
- Promote cost-cutting ideas that can have bottom line impacts. Long-term goals are great, but unless there are near-term benefits it will be difficult to bring in partners. A few near term successes can help motivate people to join the efforts.
- Utilize and train people who are already working with Industries of the Future within the state. A natural set of allies are those people who understand the IOF process and are part of the state economy.
- Become familiar with the national visions and roadmaps for each industry and potential sources of funding. Proactively write proposals to bring in new funding.
- Establish alliances with both large and small companies as well as a broad range of industry stakeholders. There is no right set of partners.
- Include universities in the process as they are not perceived as competing with industry and can provide informal contacts, good connections, and can facilitate partnerships. Use student involvement to help keep project costs down and to provide longer term benefits as students move into the work place.
- Make one-on-one contacts and visit companies around the state and region. The critical item is to communicate effectively, share experiences and team up to take advantage of new opportunities.
- Hold focused workshops around the state. Hold an annual symposium to keep the momentum going.
- Build linkages to other states, especially in regions with common industry projects and integrated industry strategies.
- Talk to technical managers or semi-senior technical people who may recognize the potential benefits to them; work from the middle out to get buy-in on the shop floor as well as at the executive level.

Tools for States

A wide variety of tools are available to assist states in initiating and supporting state-level Industries of the Future activities. These tools can be found on the Office of Industrial Technologies website: **http://www.oit.doe.gov** or can be ordered from OIT's Resource Room at (202) 586-2090. Some of the materials that various states and their industries have identified as useful are:

Case Studies

Documented case studies of best practices and lessons learned in using motor, steam, and compressed air systems and state-of-the-art process technologies often get high marks from manufacturers looking to make cost and productivity improvements in their plants.

Software and Databases

Companies are often interested in software tools that require a minimum of time and investment to use and can identify how to save money through efficient energy management of systems. Tools that industries have found helpful include:

- *ASDMaster* —teaches how to apply Adjustable Speed Drives from a total system perspective.
- *MotorMaster+* —makes the job of managing electric motor-driven systems easier by allowing comparisons of: repair vs. replace options, savings on utility bills, store and retrieve testing, and maintenance history.
- *3E Plus* —calculates the economic thickness of industrial insulation.
- *Industrial Assessment Center (IAC) database* —contains information on results of about 7,000 audits with energy, waste, and productivity recommendations made to small and mid-size manufacturing plants from the 30 university-based IACs.
- *Industrial Projects Locator* - describes and identifies contacts for ongoing industry-related research and development projects sponsored by the Federal government
- *State Information database* - provides inventory of OIT projects by state showing partners, funding, and highlights for each of the 50 states.
- *Impacts* - Database of about 100 commercial applications of OIT-sponsored technologies
- *Financial Toolbook* - step-by-step guide to financing and technical assistance options
- *National Inventory of Manufacturing Programs* - listing of manufacturing assistance programs searchable by state, name, area code, zip code or key word.

Technical Publications

Technical fact sheets, reports, workbooks, and source-books, either in hard copy, on searchable CD ROM, or on the world wide web are used by industry planners and plant engineers alike. Some of those found to be most useful include:

- *Information Resources Catalog* - comprehensive listing (in hard copy or on the OIT home page) of all OIT publications, fact sheets, case studies, software, videos, and other information products and services.
- *Improving Compressed Air System Performance: A Source Book for Industry*
- *Energy-Efficient Electric Motor Selection Handbook*
- *Industrial Assessment Center (IAC) Self Assessment Workbook*
- *Steam Challenge Energy Efficiency Handbook*
- Technical Fact Sheets - series on about 200 of OIT's technologies
- *Technical Reports CD ROM* - Full text of FY 1998 OIT technical reports

General Information and Questions

- *OIT Information Clearinghouse* (800) 862-2086 -- central access point for products and services on topics such as efficient electric motor, steam, and compressed air systems. Knowledgeable staff members are on hand to answer questions, provide advice, and disseminate products.
- Newsletters - The *OIT Times* is a quarterly publication with OIT news and updates on all Industries of the Future teams and OIT programs. *Energy Matters* covers technical articles and innovative, hands-on examples of what industry is doing to improve operations; it has the latest news in motor, steam, compressed air, and combined heat and power systems, and IACs on a bimonthly basis.
- *Building Industry Partnerships* - publication which explains a model *Industries of the Future* process and provides information on how interested parties might proceed.

Conclusions

State level Industries of the Future provide important opportunities to assist state economic growth and longer term industrial development. State and Federal governments and other stakeholders teaming with local industries can help state industries use long term visions and roadmaps which can improve their economic competitiveness, environmental performance and resource efficiency . They can also help industries utilize state-of-the-art technology and best practices to meet the challenging demands of today's markets and those of the 21st century. Energy intensive Industries of the Future are particularly beneficial to states as they often pay high wages, have a multiplier effect by supporting ancillary supplier industries and infrastructure, and by their capital intensiveness are more permanent than most lighter industries. A number of states, including those outlined in this paper, are already embracing a States Industries of the Future strategy and are showing positive results. There are many lessons learned from ongoing states work which may be widely applicable in similar efforts. Communicating experiences and collaborating within states and among states can contribute to successful prosecution of these state level efforts.

Further Reading

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